Shaikh Hasibul Karim

Interfacing With The Analog World

Review of Digital versus Analog :

A digital quantity will have a value that is specified as one of two possibilities such as 0 or 1, LOW or HIGH, true or false and so on. In practice, a digital quantity such as a voltage may actually have a value that is anywhere within specified ranges and we define values within a given range to have the same digital value. For examples, for the TTL (Tranistor-Transistor Logic) circuits we have that—

0 volt to 0.8 volt ⇒ logic '0'

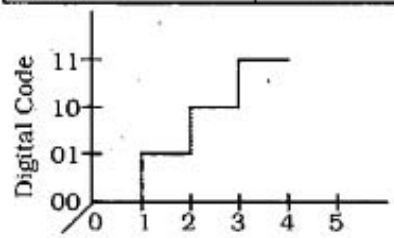
2 volt to 5 volt ⇒ logic '1'

Any voltage falling in the range 0 to 0.8V is given the digital value '0', and any voltage in the range 2 to 5V is assigned the digital value '1'. The exact voltage values are not significant, because the digital circuits respond in the same way to all voltage values within a given range.

By contrast, an analog quantity can take on any value over a continuous range of values and most important, its exact value is significant. Each possible value of an analog quantity has a different meaning.

Let's consider the following plot where the digital codes (2-bit binary numbers) along with their corresponding analog quantities are shown.

Analog ranges	Digital
0 to 1	0 0
1 to 2	0 1
2 to 3	1 0
3 to 4	1 1



[Figure-1]

Analog quantities are continuous. But the digital quantities are discrete. For example for the analog range (0-1), the analog quantity can have any value between 0 to 1. But the corresponding digital quantity is only '00' within this whole range.

Interfacing: Most physical variables are analog in nature and can take on any value within a continuous range of values. Examples include temperature, pressure, light intensity, audio signals, position, rotational speed and flow rate. Digital systems perform all their internal operations using digital circuitry and digital operations. Any information that has to be inputted to a digital system must first be put into digital form. Similarly, the outputs from a digital system are always in digital form. When a digital system such as a computer is to be used to monitor and/or control a physical process, we must deal with the difference between the digital nature of the computer and the analog nature of the process variables. The following figure illustrates the situation. This diagram shows the five elements that are involved when a computer is monitoring and controlling a physical variable that is assumed to be analog.

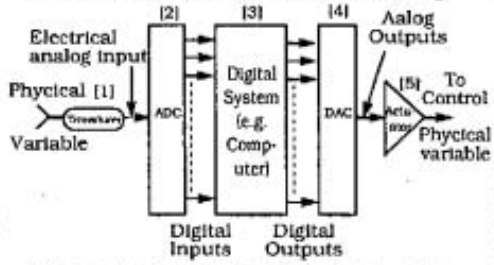


Figure-2 : Analog-to-digital converter (ADC) and digital-to-analog converter (DAC) are used to interface a computer to the analog world so that the computer can monitor and contorl a physical variable.

1. Transducer :

The physical variable is normally a nonelectric quantity. A transducer is a device that converts the physical variable to an electrical variable. Some common transducers include thermistor, photocells, photodiodes, flow meters, pressure transducers, and tachometers. The electrical output of the transducer is an analog current or voltage that is proportional to the physical variable it is monitoring.

For example, the physical variable could be the temperature of water in a large tank that is being filled from cold and hot water pipes. Let's say that the water temperature varies from 30°C to 100°C and that a thermistor and its associated circuitry converts this water temperature to a voltage ranging from 300 to 1000 mv. It is to be noted that the transducer's output is directly proportional to temperature; such that each 1°C produces a 10-mv output. This proportionality factor was chosen for convenience.

2. Analog-to- Digital Convertes (ADC): The transducer's electrical analog output serves as the analog input to the ADC. The ADC converts this analog input to a digital output. The digital output consists of a number of bits that represent the value of the analog input.

For example, the ADC might convert the transducer's 300—1000 mV analog values to binary values ranging from 00011110(30) to 01100100 (100). Note that the binary output from the ADC is proportional to the analog input voltage so that each unit of the digital output represents 10 mV. The block diagram of ADC is shown in the figure.

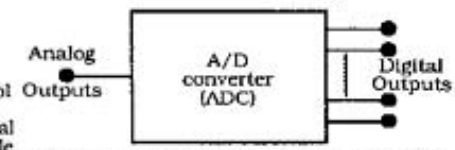


Figure-3 : Block diagram of an ADC. Number of o/p legs depends upon the digitally coded form.

3. Computer :

The digital representation of the process variable is transmitted from the ADC to the digital computer, which stores the digital value and processes it according to a program of instructions that it is executing. The program might perform calculations or other operations on this digital representation of temperature to come up with a digital output that will eventually be used to control the temperature.

4. Digital-to-Analog Converter (DAC):

This digital output from the computer is connected to a DAC, which converts it to a proportional analog voltage or current. For example, the computer might produce a digital output ranging from 00000000 to 11111111, which the DAC converts to a voltage ranging from 0 to 10V. The block diagram of DAC is shown in the figure.

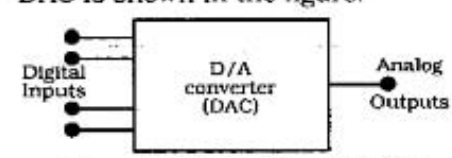


Figure-4 : Block diagram of a 4-bit DAC

(Contd. on page 34)

COMPUTERS IN INSTRUMENTATION CONTROL SYSTEMS

* M. Shorif Uddin

An instrument is a device for measuring the value of a quantity. Based on the basis operating principle instruments are classified as mechanical, electrical and electronic etc. In the early 60's electronic instruments were large vaccum tube operated units and the measurement processes were time consuming, less accurate and less reliable. After this due to the introduction of IC and digital technology, more accurate, sensitive, small size instruments are developed. In the 70's all electronic instruments were controlled by knobs, switches, displays on their front panels.

In the 80's due to PC and interface circuit revolution instruments are controlled by computers. As a result, some instruments lost their front panels and buttons by using virtual instrument (VI) concept.

Today's trends in instruments are more complex, more accurate, flexible and connected with computers for controlling, monitoring, data analysis and output presentation.

Due to advancement in the development of test equipment, now computer controlled test system is adopted for testing (either good or bad) equipment, discrete components, integrated circuits, PC boards in industries and laboratories. A simple block diagram for such automatic test equipment (ATE) system is shown in fig-1.

A computer control modern instrumentation system mainly consists of the following blocks shown in fig. - 2

In the DAQ (data acquision) block, the physical parameters are transformed into electrical signals by transducers. These electrical signals are converted to numerical data by various types of instruments which are linked with controlling microprocessor or micro computer via interface circuitry. Interfacing between microcomputer and measuring instrument is almost always done by an IEEE-488 (Institute of Electrical and Electronic Engineers USA) standard bus. The IEEE-488 bus is a general purpose interface bus (GPIB) contain both driver and receiver or transreceiver. For the name of its manufacturer it is also called the HP-IB (Hewlett Packard interface Bus). It uses 24 signals. The data transmission / reception rate is from very low to 1 M-bytes/sec. RS-232 is another such standard interface between microcomputer and serial peripherals.

Low level-instrument drivers alow the computer operating system to communicate with the interface board. Instrument drivers can address the relevant features of each instrument through a replica of the instrument front panel (i.e, by using virtual instrument (VI) concept).

A managing program (i.e. instrumentation control software) is always dedicated to supervise the instruments setting, calibration, data analysis, output presentation, storage and transmission etc.

Lastly the computer can be connected to Internet network for communication with other network.

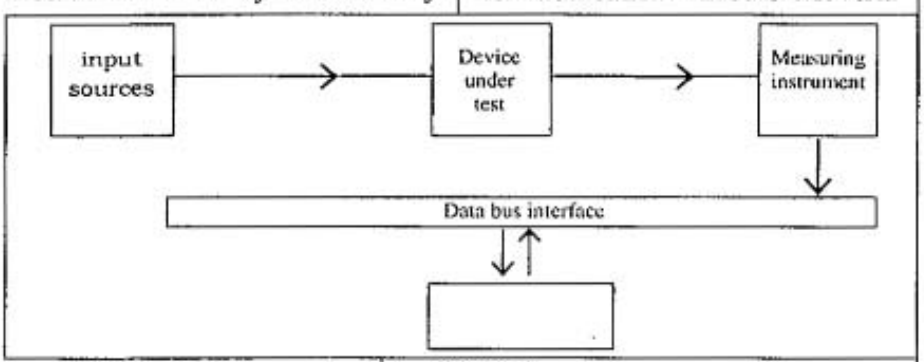


Figure-1

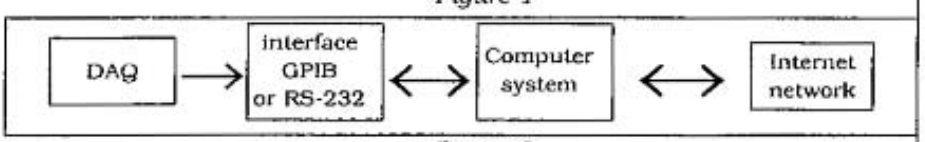


Figure-2

An ideal software for instrumentation control must have the following characteristics:—

Include low and high level drivers for all operating systems (DOS, UNIX, OS/2 etc.), easy to learn, using graphical user interface (GUI), modular form, portable (i.e. same for PC or sun workstation), easy to debug, cheap and stable.

For the 1st generation PC almost all the program (via GPIB) were written in BASIC. Scientists, engineers and technicians have to write a long tedious program for simple measurement purpose.

For this reason, in 1983 Jeff Kodosky and other Co-founder of National Instruments Co., Austin, USA decided to engage themselves to develop a new software for instrumentation control. After a long struggle, they developed a powerful standard software called Lab VIEW (Laboratory Virtual Environment Engineering Workbench). The most up to date version 3.0 of Lab VIEW has released in 1993, operated by most operating systems (DOS, UNIX, OS/2 etc.)

The fascinating features of Lab VIEW are:

(i) **Graphic user interface:** It uses the virtual instrument (VI) concept which allows to transform a real instrument into another software based instrument. As for example, a real voltmeter can be transformed into a chart recorder which is controlled by software.

(ii) **Graphical programming:** Lab VIEW programming uses block diagrams consisting of icons and connecting wires.

(iii) **Modularity:** Complex programs can be subdivided into several modules which are interconnected sequentially.

(iv) **Instrument drivers:** Includes both low and high level interface drivers.

(v) **Data analysis:** Contains more than 170 analysis functions. These are in several major groups: signal generation/simulation, Digital signal processing for spectral analysis, Digital filters for noise elimination, smoothing windows, statistics, numerical analysis, curve fitting etc.

(vi) **Data presentation:** It may correlate data graphically to maximise transmission of information.

(vii) **Communication:** Lab VIEW has drivers for TCP/IP network system.

(viii) **Portability:** Lab VIEW runs on Apple Macintosh, IBM PC compatible, Sun workstation.

(Contd. on page 34)

THE HOME COMPUTING GROWTH IN BANGLADESH

Azam Mahmood

Home computing certainly not a new concept. Perhaps one can say that it is as old as the personal computer itself.

When PCs or what were referred to initially as microcomputers were first introduced in the early seventies, they were certainly not suited for the business environment as they are today. Despite being a major break through in technology, the early models of PCs were crude, expensive and had limited use.

In those days many regarded PCs as either hobbyist kits or game machines. It should not be surprising that home users, typically computer hobbyists—were the early adopters of PCs.

With the rapid development in technology and tremendous improvement in the PC operating systems and applications, these "toys" have made a big impact in offices and homes today.

The commercial sector has certainly provided huge business, and hence, the funds for further development in the PC industry. Despite the emphasis on the corporate level by the PC industry, the home user segment plodded along.

Sophistication of the home users also increased along with technology developments. This was further escalated by the emergence of mobile computers which allows professionals to bring part of their work home.

The PC software industry has also come along way since then. Personal productivity packages such as word processors and spreadsheets are much more complex and feature-rich these days, enabling professional-quality work to be done right at home. Even computer games, which remain as major reason for PC use at home, have increased in sophistication.

In matured markets such as United States, the home segment does account for significant percentage of the overall PC business and the growth is reported to be very rapid.

In Bangladesh computer vendor tend to put more weight and attention on corporate and government sector for relatively higher profit margin and minimal sales and after sales service effort, the home computing though is still small in terms of market value, has been identified as one of the modestly growing segments in the local information technology industry.

One of the indications of this trend is the increasing number of computer retail shops in Dhaka and Chittagong. The time is not that far when computer superstores shall laminate the supermarket of the cities like consumer electronics.

The anticipated introduction of consumer PCs by major manufacturers is expected to fan the growth further within a few years here. Such products are already available in the vibrant South East Asian markets.

Arguably the majority of the home computer users in Bangaldesh are in fact students. Perhaps, one of the factors contributing to this are the growing number of computer schools, training centers, computer clubs and introduction of computer literacy syllabus in the English medium schools, in the Secondary and Higher Secondary stages and establishing of Computer Science departments in the Universities.

The Bangladeshi parents now feel that it is necessary for their children to learn to use computers. This is certainly a good sign as it will pave the way to a higher level of computer literacy in the country.

For more rapid growth of home computing segment, the Government should rationalize the present duty structure of computer and accessories. The Government should consider computer as tool to build a information technology glorified generation to face stiff challenge of mission critical in the next century, not as a source of revenue.

ANALOG WORLD

(Contd. from page 29)

5. Actuator: The analong signal from the DAC is often connected to some device or circuit that serves as an actuator to control the physical variable. For our water temperature example, the actuator might be an electrically controlled valve that regulates the flow of hot water into the tank in accordance with the analog voltage from the DAC. The flow rate would vary in proportion to this analog voltage, with zero volt producing no flow and 10 volt producing the maximum flow rate.

Thus we see that ADCs and DACs function as interface between a completely digital system, like a computer, and the analog world. This function has become increasingly more important as inexpensive microcomputers have moved into areas of process control where computer control was previously not feasible.

References:

[1] Digital systems (Principle and Applications)— Ronald J. Tocci

[2] Digital Techniques — Floyd

Instrumentation Control

(Contd. from page 32)

To install Lab VIEW in a computer the memory requirement:

minimum RAM—8MB

minimum ROM—120MB

Conclusion:

To go in parallel with the modern world, it is essential to introduce such computer control instrument system in our industries. For example, ATE system can be introduce in our radio/TV manufacturing industries for testing their final receivers. More over, for research purpose computer control instrumentation system should be adopted in our universities and research institutes.

References:

1. "Lab ViEW" by Fabio Soso, CERN, 1211 Geneva, Switzerland, October, 1994.

2. "Electronic Instruments and Measurements" by Patrick Crozier, Delmar Publishers Inc., 1985.

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KAMAL ARASALAN

SCO Launches SCO Open Server Development System Release 5

"Massive computer professionals development scheme should be taken in Bangladesh to meet the need of the fast growing local IT market"— R.N. RAJA

SCO (Santa Cruz Operation), a U.S. software company considered as the world leader in the field of system software for business critical servers (used to run critical day to day commercial activities of large and small organizations) launched their latest product SCO Open Server Development System Release 5 in Dhaka in collaboration with their local partner, Technohaven Co. SCO and Technohaven arranged a day long seminar at a local hotel which was attended by local computer and software professionals from both the government and private organizations.

The seminar was addressed by experts from SCO namely George Edelmann, technical support consultant, and Philip Dawson, Market Development Manager SCO is also a leading provider of software which integrates Microsoft Windows PCs and other peripherals with all major UNIX system servers.

SCO, a global company started its operation in 1979 and is providing solutions for business critical servers for the last 15 years. The company has established one of the industry's strongest support infrastructures, with over 6,300 authorized resellers, 100 distributors and 140 education centers in 80 countries around the world.

SCO Open Server Systems are used in running multi-user, transaction based DBMS and business applications, communication gateways, mail and messaging servers in both host and client/server environments. The new SCO Open server Release 5 combines Mini-computer-level reliability and availability with the Intel platforms superior price/performance, value and flexibility. In respect of other advanced operating systems, the most significant feature of SCO Open Server is that it accelerates productivity without obsolating existing business critical systems, applications or data.

SCO Open Server Systems, designed specially for business critical computing, provides extensible networking with existing LANs and WANs, easy conductivity with Windows desktops, built in Internet access and servers, simplified administration and management and super scalability. The Business Critical Servers of the ninety's which have out-dated the Minis of the eighty's are a new class of servers that meet the requirements of all organizations for a multi-functional, cost-effective and reliable server platform. These specific servers combine the first attributes of Minicomputer and RISC business systems, reliability, availability, serviceability (RAS) and scalability with the best attribute of the Intel platform; low total cost of ownership, excellent price/performance, widely available commodity hardware, broad selection of software applications, etc. This new class of Business Critical Servers are multi functional, fast, reliable, available, manageable and cost effective.

R. N. RAJA of SCO International, U.K.

Today's Business Critical Servers are significantly revolutionizing business productivity by delivering all the functions traditionally managed by multiple, incompatible platforms such as transaction processing hosts, application and database servers, communication and mail servers, gateway servers, and PC LAN servers in a single efficient system. This unique combination of services has ushered a new generation of applications that simplify and speed up business activities giving companies a competitive edge and enable them to better understand and serve their customers.

The Open Server product family consists of three groups of products. The first group is Base Operating System which includes the multi-user Enterprise and Host Server. Systems and the single user Desktop Systems. The second group, the layered products consists of the Windows Services Distributed Services, RAS Services and the Special Developers Services. The third group, Expert Servers includes the professional, Technical, Educational, Information and Enhancement Services.

SCO Open server, an advanced business critical server operating system consists of two configurations. The Enterprise system for the latest advanced networked and client/server computing environments and the Host System for traditional multi-user environments. The Host System does not consists of the exclusive networking capabilities of the Enterprise System, but can be easily upgraded to Enterprise System when client server capabilities are required.

SCO Open Server Desktop System is an advanced single user operating system for business critical computing that provides RISC workstation capabilities and performances on cost-effective Intel processor-based platforms. The Desktop System is excellent at running client-side transaction based applications, accessing databases, and networked information and enabling file/resource sharing and communications over a range of servers and host environments. The Desktop System is used in the present environments as a highly dependable and secure business-critical workstations in private and government enterprises, as a network management workstation and as an application development platform.

For application developments, SCO provides a range of products which allows developers to develop,

debug and deploy SCO Open Server-system based solutions. Using the SCO Open Server Enterprise, Host or Desktop System as a base platform, the SCO Open Server Development system can be combined to provide the basic Compiler, utilities and libraries required to develop host or client/server application.

SCO U.K. Ltd. through their local partner Technohaven, has announced that to encourage the local software professionals, they are offering SCO Open Server Release 5 at a very discounted rate of Tk. 60,000/- only from their present limited stock on the first come first serve basis. The original price is Tk. 1,52,000/-. This package will include the Enterprise System and Desktop System along with the development system. Anybody interested to have a demo copy will have to submit 2 floppy disks at Technohaven.

R.N. RAJA regional sales manager, SCO International, U.K. and leader of the 3-member SCO team in Dhaka is a computer science graduate from Canada. He is associated with the I.T. industry since '76 and has served in Canada, U.S.A. Middle-East, ASEAN countries, China, U.K. etc.

As this was Raja's second visit to Dhaka after two and half years, while giving an interview to "Computer Jagat" he said that awareness for computerization has gone up significantly. Bangladesh has a huge potential in the IT field and as it is located in the fastest growing region of the globe it is obvious that a lot of developments will take place in Bangladesh within a short time.

Being a late-comer in the computer-software field, Bangladesh enjoys a major advantage. Whereas in the developed countries who have already invested a huge amount in Mini and Mainframes have got virtually locked up and struggles to switch over to the latest computer systems, Bangladesh having invested very little in this field can now easily go for installation of the latest PC's, Servers and other peripherals.

During his recent visit Raja has been in different computer establishments in Dhaka. He is happy with the recent developments in Bangladesh and is going to give a green signal to his headquarters informing that the SCO products have a good prospect in Bangladesh.

Raja noticed that acute shortage of skilled manpower exists in the local computer industry. Highly trained and skilled manpower is a basic requirement for the rapid development in the I.T. sector. The interprenuers and companies will feel interested to go for computerization if they are provided with the full use of all the features of today's advanced software systems which requires highly skilled computer professionals.

He suggested that massive computer professionals development scheme should be taken in Bangladesh to meet the need of the fast growing local market. When asked whether his company can play a role in this field he replied that his company does not have the policy to set up training centers directly but is always interested to provide training through local partners. Interested local computer companies may contact the SCO International in this regard. ●

ATM— REVOLUTION

(Contd. from page 40)

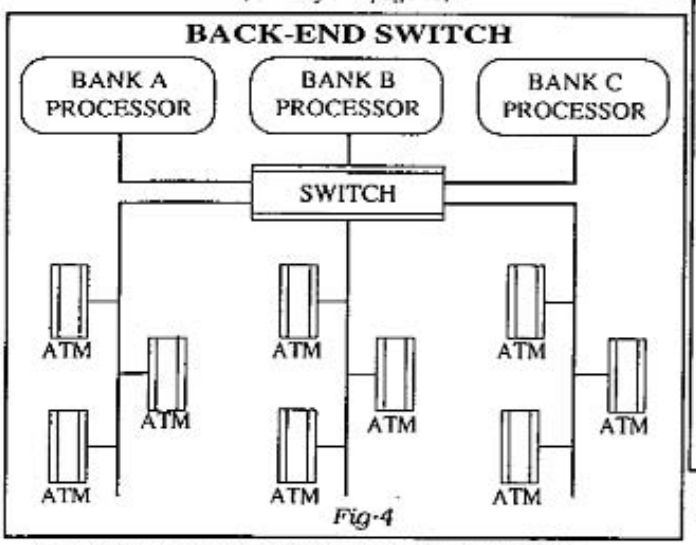

Fig-4

ADVANTAGES OF THE CONFIGURATION :

The advantage of this configurations - each Network participant is relieved of the burden of having to build an ATM management and staff to network monitoring function around the clock.

Disadvantage of Front-End Switch include the capacity needed at the switch to handle every transaction message in the network and the transaction costs for switching incurred by participants.

BACK END SWITCH

In a back end switch each ATM is directly linked to its owner's data center and data center is linked to the switch. The switch is behind the data processor.

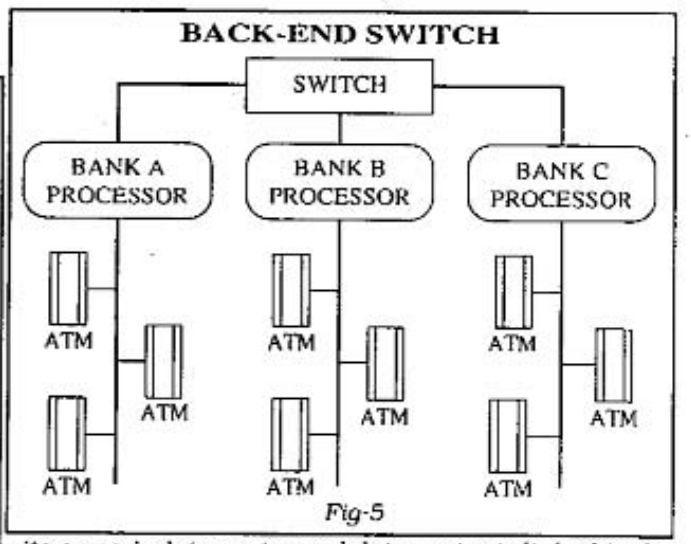

Fig-5

If the card owner belongs to another bank, the transaction is sent to the Switch for proper routine. Each data center is driving its own ATMs and the Switch never sees the transactions of the financial institution's own customer. When a customer to one member in the Network performs a transaction at the ATM or another member, the message is sent to the Switch then routed to the appropriate bank to obtain authorization, Which is then relayed back through the Switch to the ATM.

*** MD. Mokbul Hossain**
Senior Executive
Leads Corporation Ltd.
Dhaka.

ATM– REVOLUTION FOR BANGLADESH BANKING SECTOR

(Concluding part)

TRANSACTION PROCESS

To begin a transaction, the customer inserts his ATM card into the ATM. The PIN is then manually entered via the ATM keypad by the customer. The ATM reads the account number from the magnetic stripe on the back of the card and the PIN offset. Then the ATM performs one of the following process :

The ATM sends the account number and an encrypted or scrambled PIN to the Host. The Host verifies that the PIN and card matches and sends an O.K. back to the ATM. The customer then can begin his/her transaction.

Or, The ATM reads the customer number and PIN entered by customer, calculates it via a mathematical formula and compares the results with the customer's offset on the card's magnetic stripe. If the number matches the customer can begin the transaction.

If the number does not match, the ATM will decline the customer until the correct PIN is entered. The ATM usually allows the customer three (3) attempts to enter the correct PIN number. If the pin number is incorrect after three tries, the customer is locked out of the system. The number of attempts the customer is allowed however, is determined by the bank through the software program.

MODES OF PROCESSING

ATM System have three methods of processing :

1. Stand-alone
2. Off-line
3. On-line

1. STAND-ALONE SYSTEM

Stand-alone system are self-contained systems. In other words, transactions are performed away from the Host which maintains the customer files. Therefore the customer's balance can not be verified. In Stand-alone transaction, the ATM reads the information from the customer ATM card, which is (information) encoded on the card's magnetic stripe. It includes the following :

- Account Number
- Daily withdrawal limits and
- PIN Number

All transactions processed on a Stand-alone ATM System are stored at the ATM level until a batch processing can occur to update the central customer files. An update is performed once a day, usually after business hours. During this update, the daily transaction files is then sent to the Host and the customer files are updated. In this environment, the customers get very limited services and the bank also have to manually do many function to update customers account.

2. OFF-LINE SYSTEM

Off-line systems receive direction from controller (sub-host). The controller receives data from individual ATMs, process it and transmits commands to the individual ATMs. The controller contain the customer information file (which contain the customer's balance) and transaction file. Once a day this file is sent to the Host to update the customer account balance. This is also known as "memo-posting". It can serve multiple ATMs and is capable to operating the ATMs whenever the main computer is out of service. This environment has substantial benefits both to the customers and bank, specially in country like Bangladesh.

3. ON-LINE SYSTEM

In On-line Systems the transaction is initiated at the ATM. The customer data is sent to the Host which directly updates the customer file when the transaction takes place.

ATM NETWORK

The objective of the ATM Network :

- Increased customer convenience
- Revenue generation/Cost reduction
- Positioning

NETWORK CONFIGURATIONS

The Shared System (different banks or institutions can share their ATMs) can be operated as a **single processor** or as **multiple processor in a distributed processing network** employing a SWITCH for routine transaction messages to the appropriate Host (Database).

Now I try to explain about distributed processing Network.

DISTRIBUTED PROCESSING :

In the distributed processing Network, more than one data processing center is linked via a Switch, which routes transactions messages between data processing centers. Switching is the mechanism through which ATM interchange is accomplished. In addition to message routing, the switch, which is a software program usually residing on a separate computer, can perform information reporting, settlement and processing functions.

SWITCH

The basic switch software for is the routing of message to their appropriate destinations. Messages are accepted from ATMs read by the Switch and transmitted to the intended processor. The processor authorizes or denies the requested transaction and sends the completed massage back through the switch, which routes in back to the originating ATM.

FRONT END SWITCH

Several configurations are possible for the Network developed around a switch. The Front-End-Switch is on in which all network ATMs tie directly to the switch, and the financial institution's data centers are behind the switch.

The Switch is in front of the data processor. All transactions go directly to the Switch which determines the financial institutions holding the customer's account and routes the transaction messages.

(Contd. on page 36)